

PRINCIPLES OF FRACTURES



Traverse

Dr. Samira Awad Satti FRCS (Ireland)

Orthopedic Surgeon

Assistant Professor

PNU 2016

Objectives

Basic Knowledge about →

- How fractures happen
- Types & classification of fractures
- Management of closed #s
- Complications of #s
- Fracture Healing

Note

*Topics **NOT** included in this session are →*

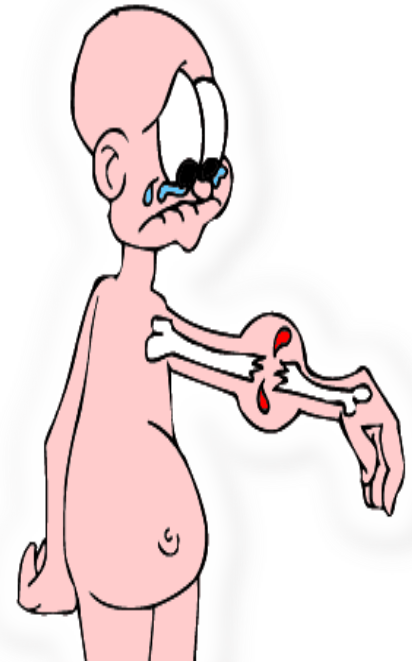
I. Open Fractures

II. Fractures in children

*These topics are dealt with **separately***

Introduction

- A **FRACTURE** is a **BREAK** in the structural continuity of **BONE**
- It may be → Crack or hair-line
 - Complete; Incomplete
 - Displaced; Non-displaced
 - Open; Closed
 - Intraarticular
- Fractures result from → **TRAUMA**
 - **PATHOLOGY**



Remember

*A fracture is a **SOFT TISSUE injury** in which the **BONE** is broken*



Classification of fractures

- **Simple →**
 - Transverse
 - Oblique
 - Short oblique
 - Spiral
 - Avulsion
- **Multi-fragments →**
 - Butterfly
 - Comminuted
 - Segmental
 - Compression

Classification



Transverse



Oblique



Butterfly
Fragment



Spiral



Comminuted



Segmental

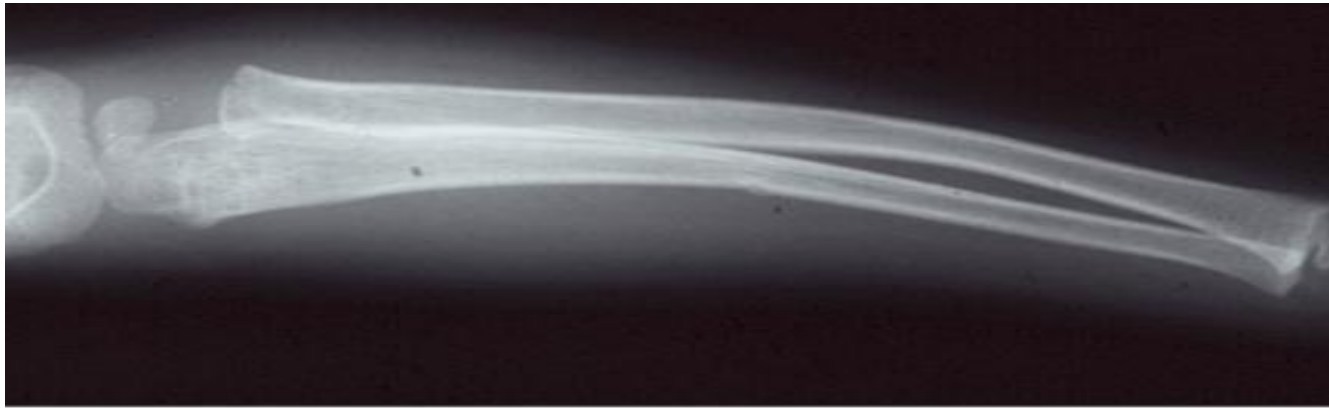
Classification

Compression

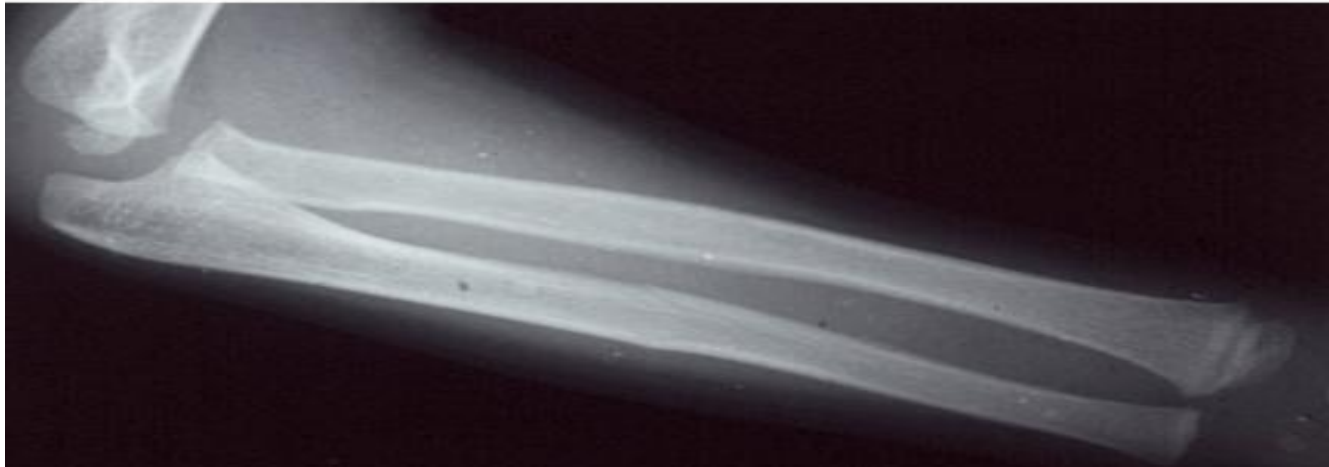


Incomplete

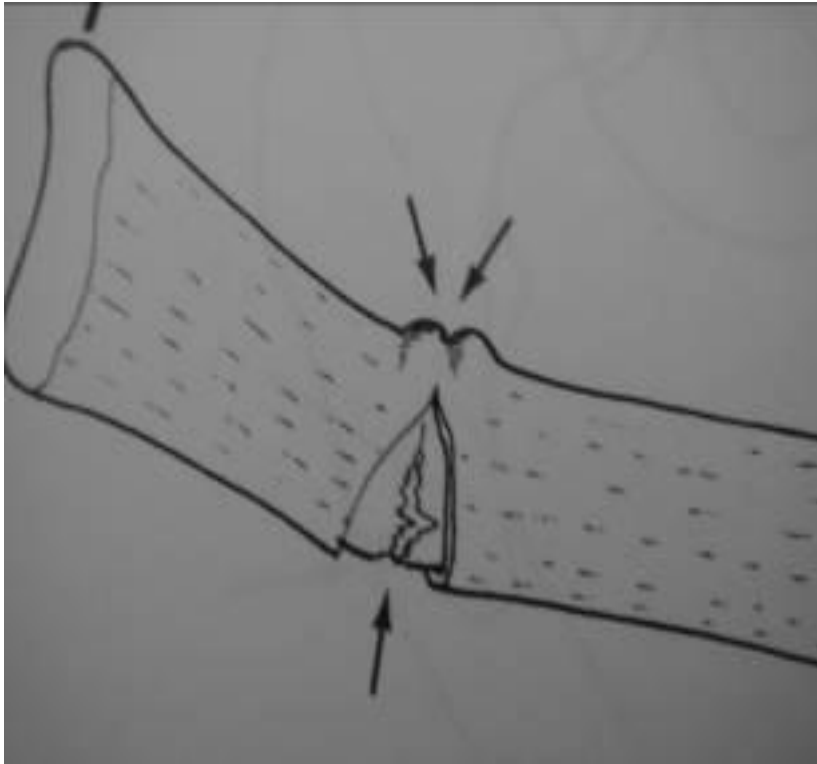
Plastic deformation



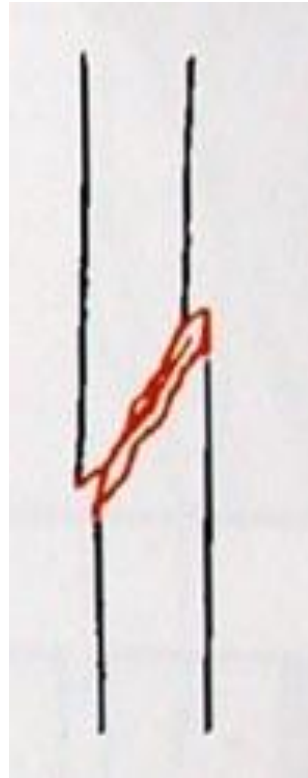
(b)



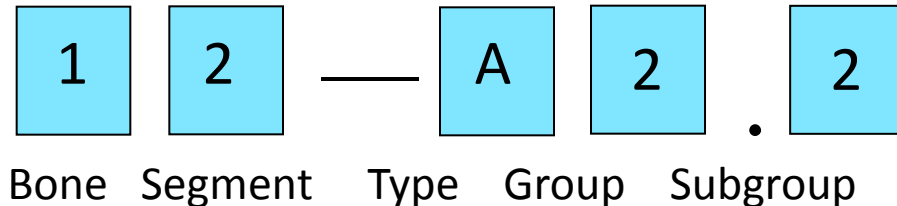
Green-stick



AO/OTA Classification (*Alphanumeric*)



<i>Bone</i>	Humerus	1
<i>Segment</i>	Diaphysis	2
<i>Type</i>	Simple	A
<i>Group</i>	Oblique	2
<i>Subgroup</i>	Middle	2



Fracture Displacement

- Translation → Shift (M-L/ A-P)
- Angulation → Tilt (M-L/ A-P)
- Rotation → Twist
- Impaction
- Length → Overlap / Distraction
- Combinations

Management

→ ATLS

- Clinical presentation
- Imaging
- Investigations
- ttt

Clinical Picture

- **H/O** → Trauma (ATLS)

(Note that in pathological #s trauma could be trivial)

- **C/O** → Pain; Deformity; Inability to move the limb; There could be an associated wound or other injuries

- **O/E** → Look, Feel, Move

(N/V status)

Clinical Picture

Secondary Injuries → (ATLS)

- Thoracic
- Spinal
- Pelvic & Abdominal
- Others (Skull, OMF, etc)

Imaging

- **X/R** → Rule of 2
- Special Imaging →
CT, MRI, Angiography, US

Investigations

Depending on the cause → Trauma

→ Pathological

- CBC
- Blood grouping & cross-matching
- Chemistry → LFT; KFT (Bone & Hormone profiles)
- Serology
- Microbiology → C&S; Gm-stain; others
- Histopathology & Tumour markers

ttt of Closed Fractured

1- Conservative

2- Operative

ttt of Closed Fractures

Basic Points

Fractures are **immobilized** to →

1. Alleviate **pain**
2. Ensure good **alignment** for union
3. Permit early **mobilization** of the limb and return of function
4. Avoid complications of prolonged recumbancy

Conservative

(Reduce → Hold → Exercise)

- Closed Reduction for displaced #s
- Cast; Brace; Splint
- Traction (continuous) → Gravity (UL)
 - Skin
 - Skeletal
- Exercise accordingly

Conservative ttt



Short Arm Cast

Long Arm Cast

Arm Cylinder Cast



Short Leg Cast

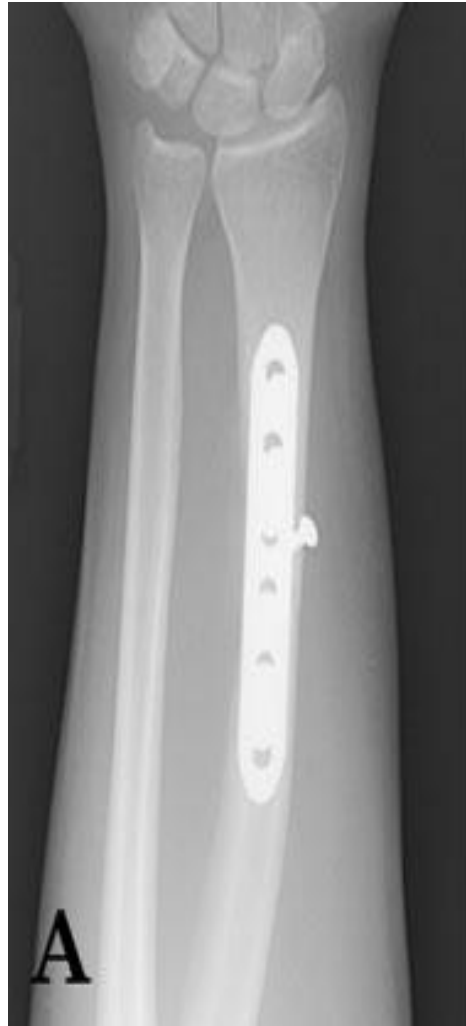
Leg Cylinder Cast

Long Leg Cast

Operative ttt

- Open Reduction + Internal Fixation
- Closed Reduction + Internal Fixation

Types of Internal Fixation



Types of Internal Fixation



Stress Fractures

- A # attributed to prolonged continued stress (seen in military; athletes; dancers)
- **Clinical Features:-**
 - C/O pain on walking;
 - O/E tender swelling over 2nd or 3rd MTB
- **XR** → Non-displaced hair-line # +/- callus

Stress Fractures

ttt → Usually heals spontaneously, otherwise B/K splint for 3 or 4 weeks



Pathological Fractures

- Definition → # in a **diseased bone**
- **Types** → Congenital (O.I); Metabolic; Benign or Malignant
- **Clinical Features** → Pain; Deformity; +/- constitutional \$
- **Imaging** → X/R; CT; MRI; Bone scan
- **ttt** → According to cause; Cast; ORIF + BG;
(NB, in case of malignancy → Biopsy + Fixation)

Pathological Fractures



Complications of Fractures

- **LOCAL**
- **GENERAL**

Local Complications

- **Early →**

N/V; Soft tissue injury; Infection; Stiffness
Sudek's atrophy;

- **Late →**

Delayed union; Mal-union; Non-union; AVN; LLD; Wasting; OA;
Volkmann's ischemic contracture

→ In **Children** → **Growth-plate** injuries

General Complications

- Hypovolemia (Pelvis, Femur, etc.)
- ARDS
- FE
- DVT / PE
- Functional disability

Fracture Healing

Healing takes place through →

1- **Direct** union

2- **Indirect** union (**Callus**)

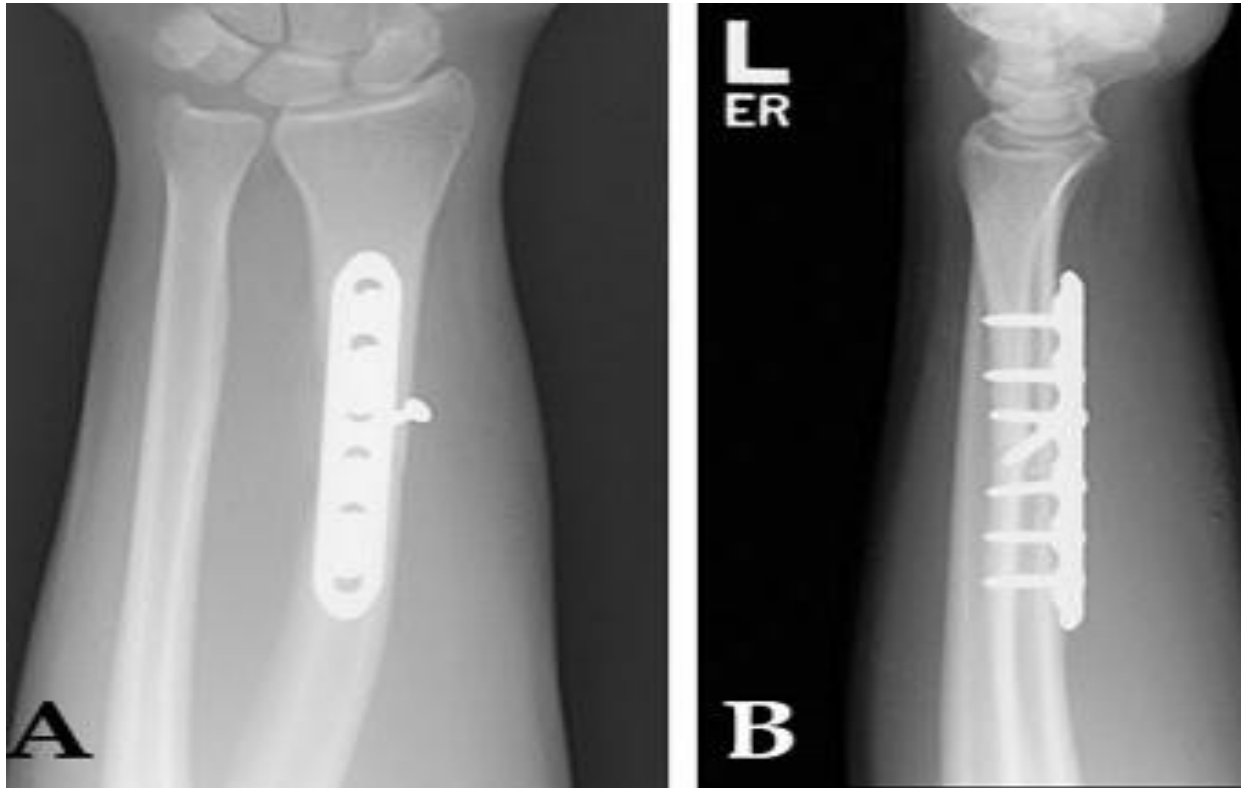
Fracture Healing

- A common misunderstanding is that, in order for a fracture to heal, it has to be immobilized
- Fractures heal naturally by **Callus** formation whether immobilized or not
- To unite **without deformity**, fracture ends are to be **approximated** and **aligned**.
- Callus formation is stimulated by movement

Fracture Healing

1- Direct Union

- When # ends are opposed & rigidly fixed
- Through direct osteoblastic new bone formation between the fragments



Fracture Healing

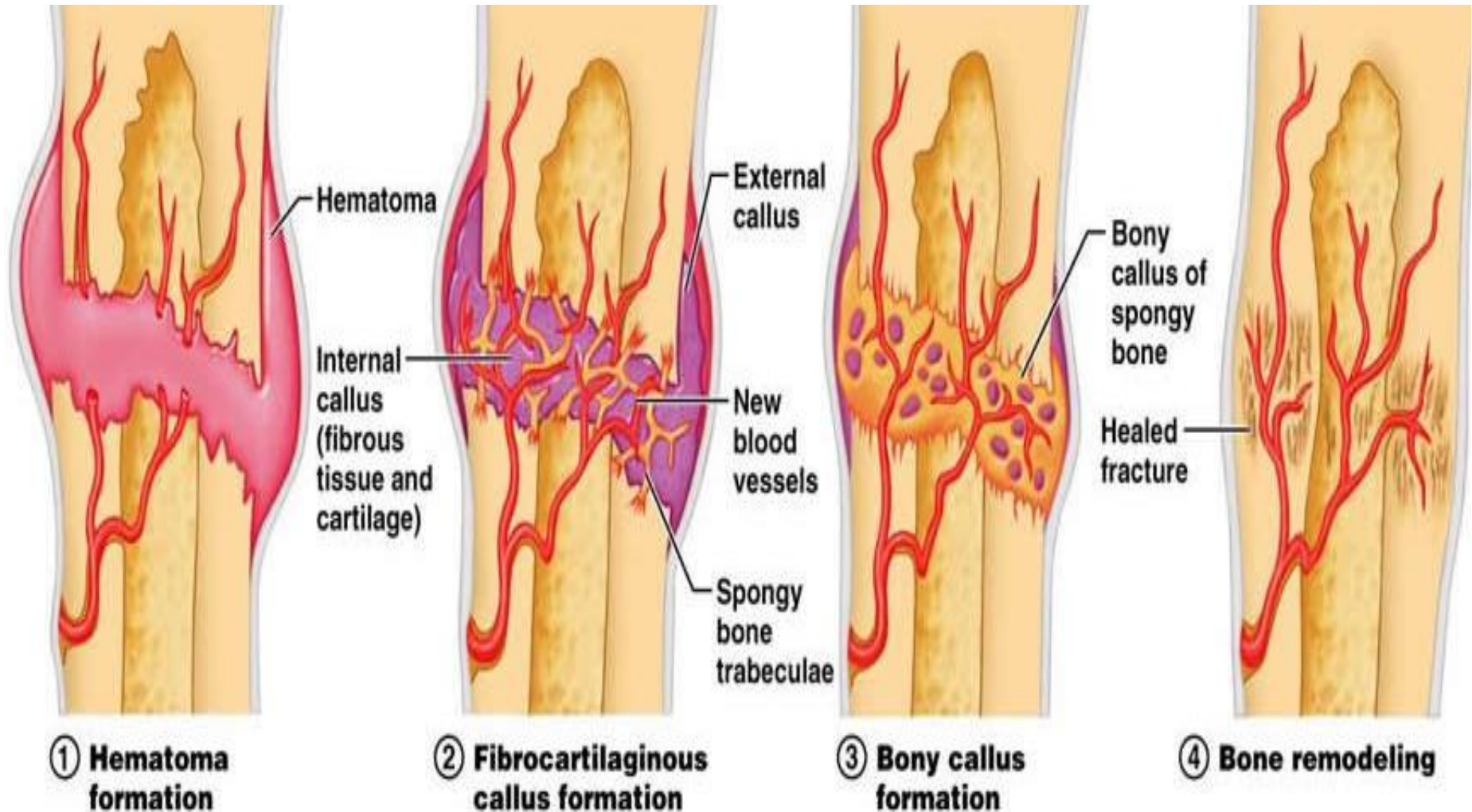
2- Indirect union (callus)

- In the **absence** of rigid fixation
- **Natural** form of healing in Tubular bones

Five stages →

- i) Tissue destruction & Hematoma
- ii) Inflammation & Cellular proliferation
- iii) Soft Callus
- iv) Consolidation (hard callus)
- v) Remodeling

Healing by Callus



Healing by Callus



Nonunion

Definition →

A # that has **not healed** & has **no potential to heal** without further intervention

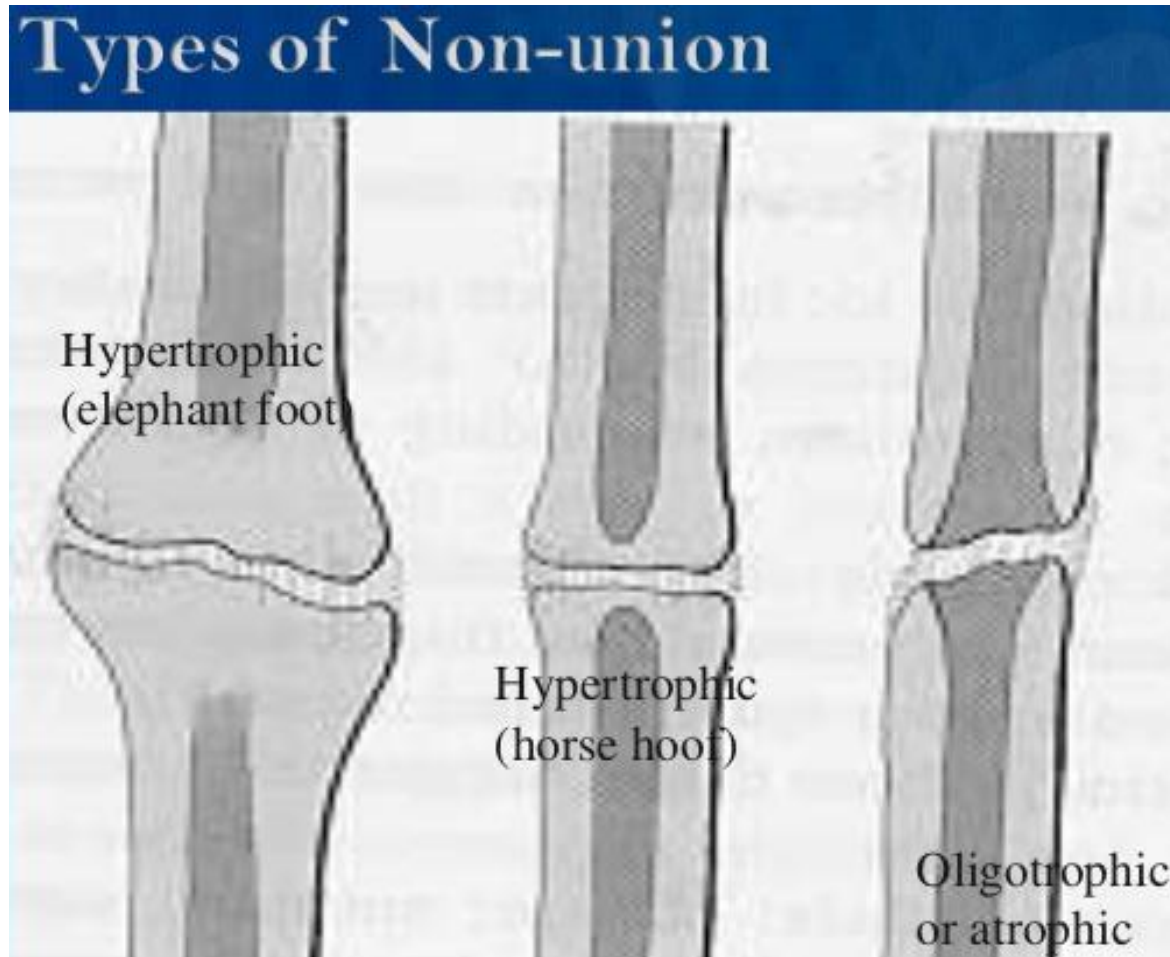
1. **Delayed union** → Prolonged (more than expected)

2. **Nonunion** → Atrophic (avascular)

→ Hypertrophic (vascularized)

3. **Malunion** → Healing with a wrong alignment

Types of Non-union



Non-union & Mal-union



Nonunion

Causes →

1. **Host Factors** → Local Vs Systemic (smoking, anemia, immune-deficiency, Infection, etc.)
2. **# Factors** → Soft tissue interposition, distraction, etc

Treatment

- **Delayed union:-**

- Deal with the **underlying cause** (anemia, smoking, excessive movement at # site, etc)
- **Promote** healing (exercise to improve blood supply, PWB, bone growth-promoting factors)
- **ORIF**

- **Non-union:-**

1. **Hypertrophic** → ORIF + **Compression**
2. **Atrophic** → ORIF + **B.G**

Note → Surgical trauma could further jeopardize the soft tissue status